

REMARKS

Applicants respectfully request reconsideration of the present application, as amended, and consideration of the following remarks.

Claims 1-28 are pending in the application. Claims 1-28 are rejected.

Claims 1, 2, 12, 22, 25, 26, and 28 have been amended and claim 27 has been cancelled.

Applicants have amended their application as indicated above and respectfully request entry of the amendment under 37 C.F.R. § 1.116 since the amendment places the application in condition for allowance and/or better condition for appeal as set out below. Support for the amendments can be found in the specification, claims, and drawings as originally filed. In view of the above listed support for the amendments, it is respectfully submitted that the amendments do not add new matter.

35 U.S.C. § 112 Rejections

In the present Office Action, the Examiner has rejected claims 1 –21, 25, and 26 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In particular, the Examiner has stated:

Claims 1 and 25 contains the trademark/trade name Siloxirane™ . Where a trademark or trade name is used in a claim as a limitation to identify or describe a particular material or product, the claim does not comply with the requirements of 35 U.S.C. 112, second paragraph. See *Ex parte Simpson*, 218 USPQ 1020 (Bd. App. 1982). The claim scope is uncertain since the trademark or trade name cannot be used properly to identify any particular material or product. A trademark or trade name is used to identify a source of goods, and not the goods themselves. Thus, a trademark or trade name does not identify or describe the goods associated with the trademark or trade name. In the present case, the trademark/trade name is used to identify/describe a resin containing O-Si-O groups, along

with a reactive organic functional group, and an aromatic group, whereas Applicant is reciting a resin containing O-Si- groups, along with a reactive organic functional group, and an organic chain segment, and, accordingly, the identification/description is indefinite.

(pgs. 2-3, Office Action 11/20/02).

In response, the Applicants have deleted all references to Siloxirane™ from the claims. Accordingly, it is respectfully submitted that claims 1– 21, 25, and 26 now comply with 35 U.S.C. § 112, second paragraph. The Examiner is accordingly respectfully requested to withdraw his rejection of these claims.

35 U.S.C. § 103 Rejections

The Examiner has rejected claims 1, 9-11, 13-17, and 19-28 under 35 U.S.C. § 103(a) as being unpatentable over Wong (U.S. Patent No. 6,180,696) in view of Keehan (U.S. Patent No. 5,026,816).

In particular, the Examiner states:

Regarding claim 1, Wong et al. teaches a no-flow material comprising:
an epoxy resin (first line of abstract);
at least one agent acting as a cross-linking hardener (Col. 5, lines 1 and 2) and a curing catalyst capable of catalyzing the curing of the epoxy resin (Column 5, lines 13-22); and
a fluxing agent (Column 5, lines 23-47).
Wong et al. does not teach a Siloxirane™ epoxy resin.

Keehan discloses a Siloxirane™ epoxy resin (Column 3, lines 53-56; Column 4, lines 3-6 and 36-39). It would have been obvious to one of ordinary skill in the art to incorporate the Siloxirane™ epoxy resin taught by Keehan into the device taught by Wong et al., since Siloxirane™ epoxy resin is a known material that is well suited for the intended use. The selection of a known material based on its suitability for its intended use supported a *prima facie* obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). It would have been further obvious to employ the Siloxirane™ epoxy resin since it has enhanced chemical and corrosion resistance, high adhesive strength, high heat deflection temperatures and toughness (Keehan, Column 3, lines 17 – 19).

(pgs. 3-4, Office Action 11/20/02)

Applicants however respectfully disagree that claims 1, 9-11, 13-17 and 19-28 are unpatentable under 35 U.S.C. § 103 (a) as suggested by the Examiner.

Claim 1 as amended includes the following limitation:

A no-flow underfill material comprising:

an epoxy-based resin including oxirane grafted silica particles;
at least one agent acting as a cross-linking hardener and a curing catalyst capable of catalyzing the curing of the epoxy-based resin; and
a fluxing agent.

(Amended claim 1) (emphasis added)

The oxirane resin disclosed in Keehan (U.S. Patent No. 5,026,816) does not include oxirane grafted silica. Accordingly, it is respectfully submitted that the combination of Wong, et al (U.S. Patent No. 6,180,696) and Keehan fails to teach or suggest the above limitation of claim 1.

In no-flow applications, a key challenge is to ensure that added silica particles are not trapped in between the die bumps and substrate bumps. In the oxirane grafted silica particles, the oxirane organic segments are coated on the surface of each silica particle, and all the oxirane segments on the silica particles are well dissolved in liquid oxirane compounds (epoxy-resins) since the oxirane group on silica particles and on liquid epoxy resins are the same. This ensures strong molecular level interaction/solubility. Thus, the oxirane coated silica particles are more difficult to conglomerate and are more easily displaced with liquid epoxy resin flow during no flow assembly processes than silica particles. As a result, the problem of silica settling is reduced. Further, since the silica particles are coated with the oxirane group, interfacial strength between the silica particles and the cured epoxy matrix is improved over the case in which the silica particles are simply added into epoxy resin without the chemical bonding between the

oxirane group and the silica particles. Further, by using oxirane grafted silica particles, there is no need to separately add silica filler to reduce the coefficient of thermal expansion of the no-flow underfill material.

On account of the foregoing, it is respectfully submitted that the combination of Wong and Keehan does not render claim 1 as amended, unpatentable under 35 U.S.C. 103(a).

Given that claims 2-24 depend on claim 1, it is respectfully submitted that these claims are also not obvious in view of the combination of Wong and Keehan.

Independent claims 22, 25, and 28 include the limitation of:

“... an epoxy-based resin including oxirane grafted silica particles.”

For the reasons discussed with respect to claim 1, it is respectfully submitted that claims 22, 25, and 28 are not unpatentable under 35 U.S.C. § 103 (a) in view of the combination of Wong and Keehan.

Further given claims 23, 24 depend from claim 22, and 26, 27 depend from claim 25, it is respectfully submitted that these claims are also not obvious in view of the combination of Wong and Keehan.


Applicant respectfully submits that the present application is in condition for allowance. If the Examiner believes a telephone conference would expedite or assist in the allowance of the present application, the Examiner is invited to call Vani Moodley at (408) 720-8300.

Please charge any shortages and credit any overages to Deposit Account No. 02-2666. Any necessary extension of time for response not already requested is hereby requested. Please charge any corresponding fee to Deposit Account No. 02-2666.

Respectfully submitted,

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CLAIMS WITH MARKINGS TO SHOW CHANGES

1. (Twice Amended) A no-flow underfill material comprising:
an epoxy [SiloxiraneTM]-based resin including oxirane grafted silica particles;
at least one agent acting as a cross-linking hardener and a curing catalyst capable of
catalyzing the curing of the epoxy-based resin; and
a fluxing agent.
2. (Twice Amended) The material of claim 1 wherein the epoxy- [SiloxiraneTM] based resin is
represented by:

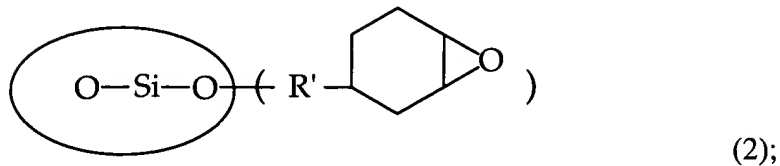
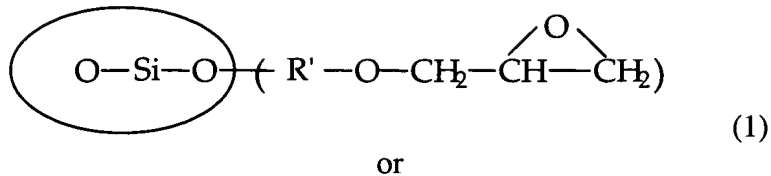


where R1 includes SiO₂

R2 is a reactive organic functional group, and

R3 is an organic chain segment.

12. (Twice Amended) The material of claim 1 wherein the fluxing agent is dissolved in a
mixture of the epoxy [SiloxiraneTM]-based resin and the agent acting as a cross-linking hardener.
22. (Twice Amended) A no-flow underfill material comprising:
an epoxy resin including oxirane grafted silica particles and being represented by



at least one agent acting as a cross-linking hardener and a curing catalyst capable of catalyzing the curing of the epoxy resin; and
a fluxing agent.

25. (Twice Amended) A semiconductor package comprising:

a package substrate;

bond pads on the substrate;

a semiconductor die;

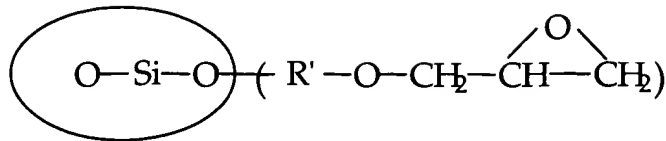
contact pads on the semiconductor die;

a respective conductive bump on each contact pad, the die being located so that each bump is in contact and attached to a respective bond pad; and

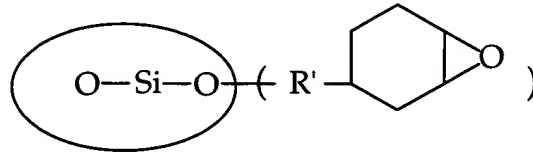
an underfill material filling regions between the bumps and including at least an epoxy [SiloxiraneTM]-based resin including oxirane grafted silica particles.

26. (Twice Amended) The semiconductor package of claim 25 wherein the epoxy

[SiloxiraneTM]-based resin is represented by:



or



27. (Cancelled)

28. (Amended) A semiconductor package comprising:

a package substrate;

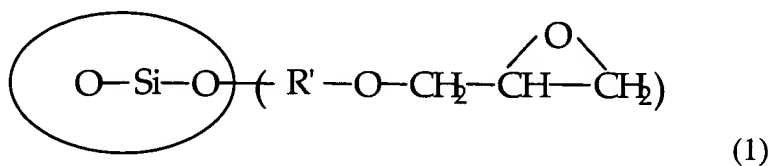
bond pads on the substrate;

a semiconductor die;

contact pads on the semiconductor die;

a respective conductive bump on each contact pad, the die being located so that each bump is in contact and attached to a respective bond pad; and

an underfill material filling regions between the bumps and including at least an epoxy-based resin including oxirane grafted silica particles, and being represented by:



or

